Research Article

Modeling and Structural Analysis of Rear Axle Casing of Tractor

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ABSTRACT: In this research paper we are going to analysis the rear axle hosing of the tractor for circular, rectangular and elliptic shape to improving the structural stability and load carrying capacity, deformation and fatigue analyze done in FEA methodology, model designed in CATIA software.

Keywords: Rear axle hosing, FEA, Rectangular and elliptical hosing, CATIA

INTRODUCTION

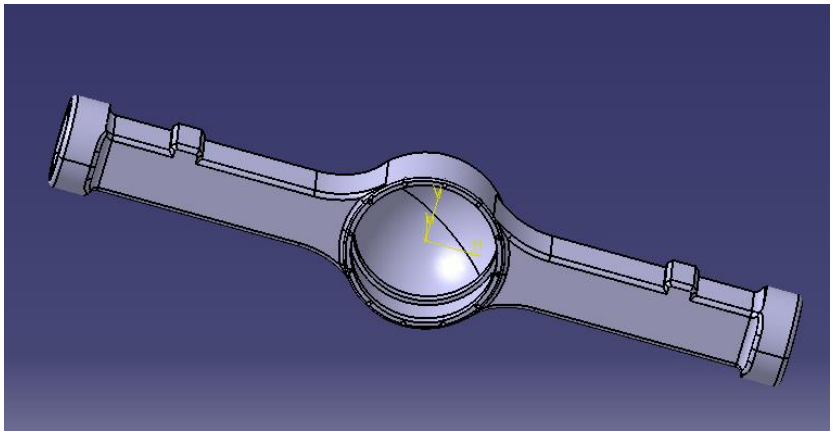
In tractor rear axle having more amount dynamic load because continuous rotation, here the applying load and cycle of rotation also high , therefore the axle component life will be reduce or it will be damaged before reaching maximum load factor. The rear axle material should withstand this fatigue load that's why choosing SG 500 casting iron; it has more wear resistance, high toughness, fatigue resistance and also having excellent ductility characteristic.

Here we going to modify the rear Axle shape from circular to rectangular and elliptical shape but the material are same. With help of Finite element method technique we can able to ductile and fatigue analysis this modified shape for required boundary condition,

The model is designed in CATIA software, meshing and analysis done in FEA software, finally we compare the deformation fatigue results for three shape.

MODELING

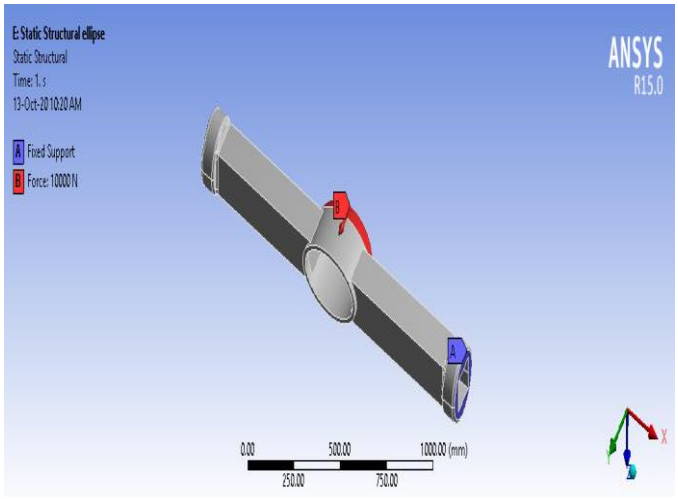
Modeling of rear axle housing done in CATIA Software for TAFE 1002 4WD tractor the model have the circular shape of the housing structures, these structures can be modified as the rectangular shape and elliptical shapes



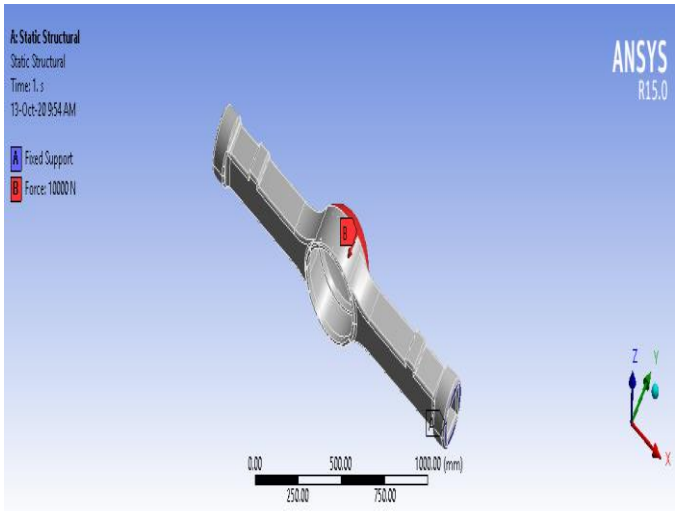
MODELING OF REAR AXLE CASING FOR TRACTOR

Structural Boundary Conditions for rear axle housings
Support: fixed support
Load: 1000N
Length: 1m
No of division: 1000

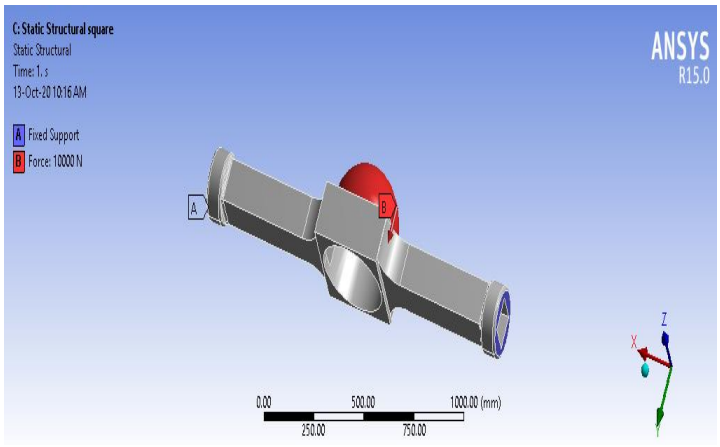
FEA model



Circular shape

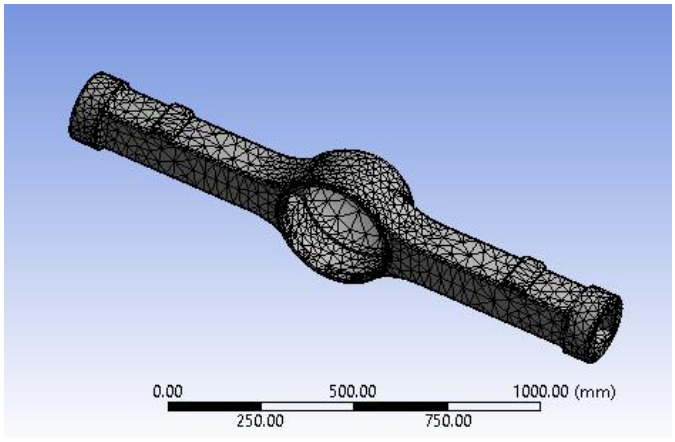


Elliptical shape

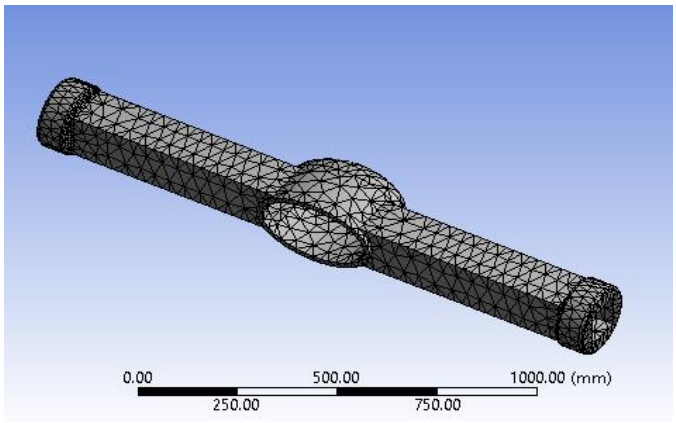


Rectangular model

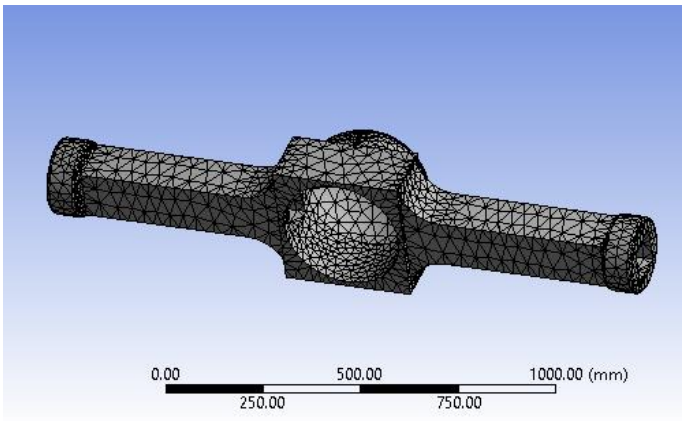
Meshing:
Meshing done in FEA software here we used tetrahedral elements for more accuracy.



Circular shape

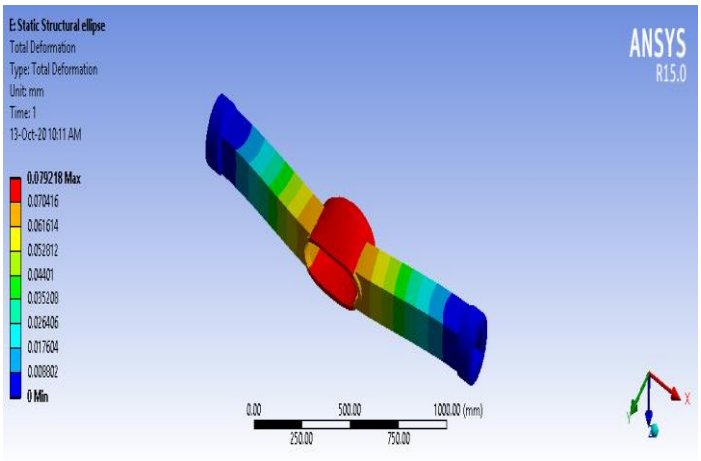


Elliptical shape

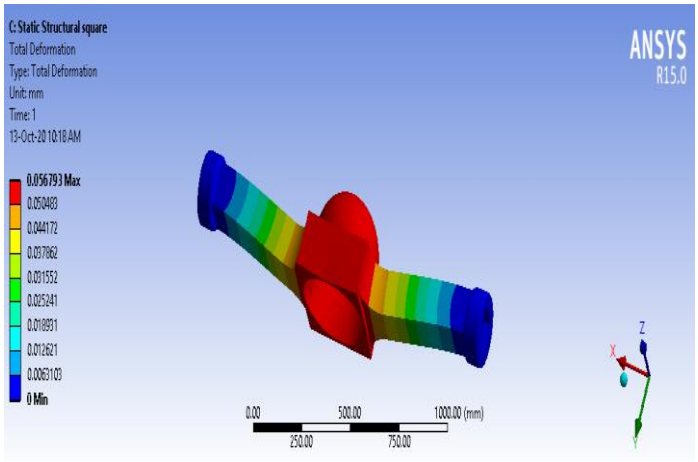


Rectangular shape

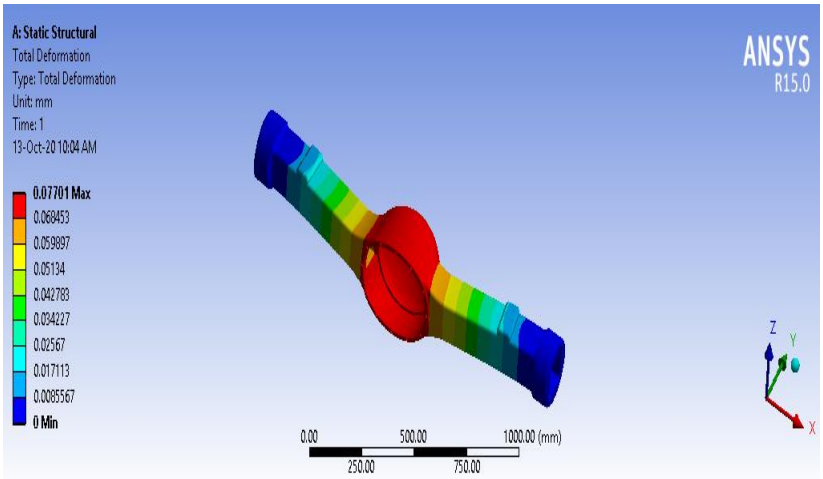
Structural Analysis and Results:



Elliptical shape

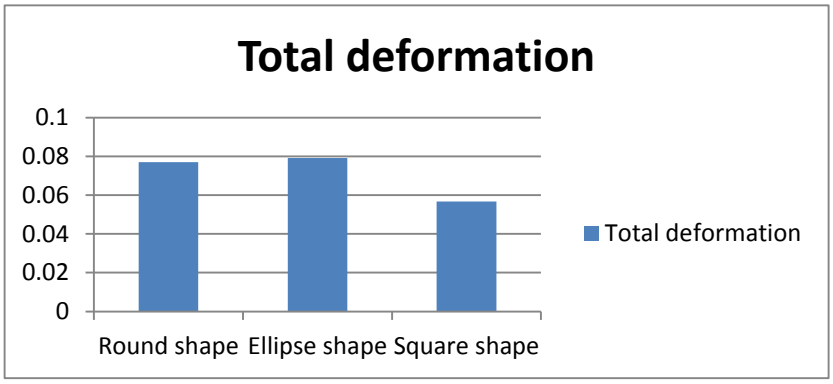


Rectangular shape



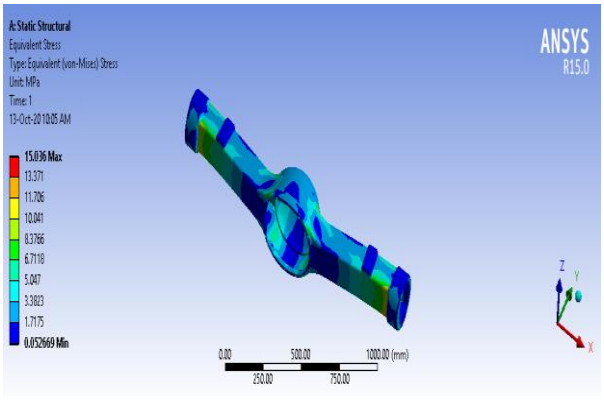
Deformation results:

Shape	Total deformation
Circular shape	0.07701
Ellipse shape	0.079218
Rectangular shape	0.056793

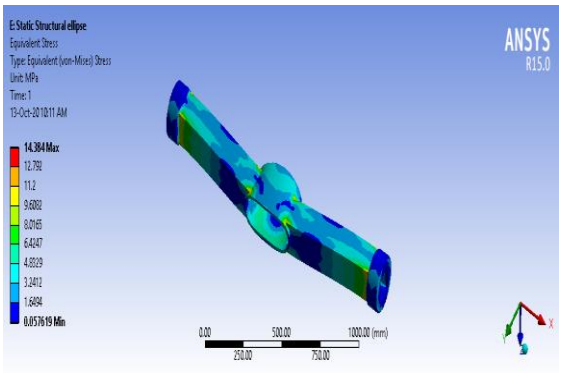


Total Deformation results of rear axle housings

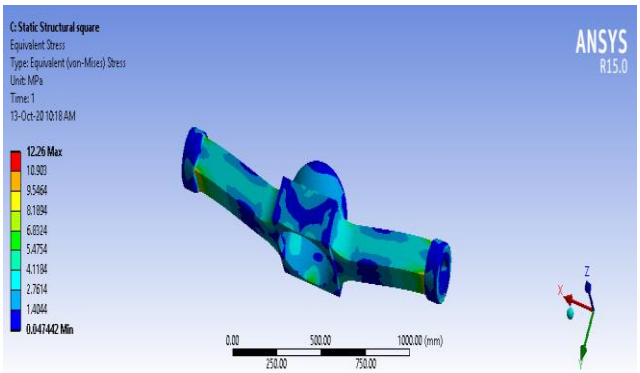
EQUIVALENT STRESS



Elliptical Shape



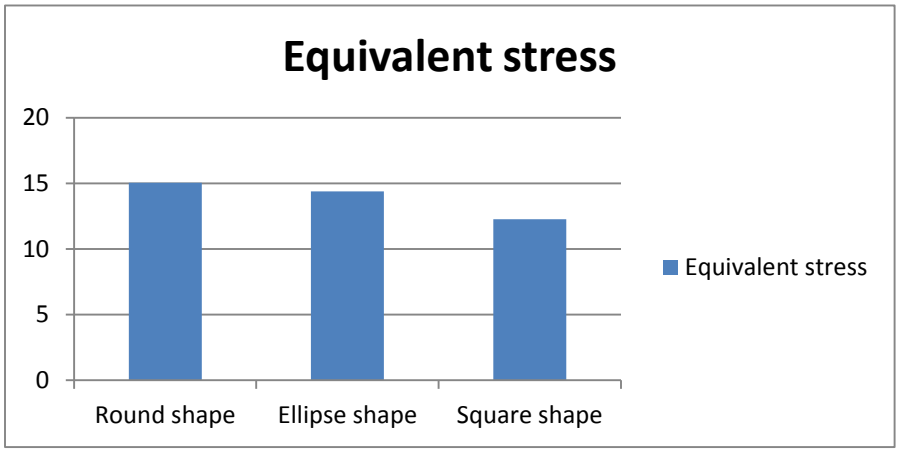
Circular shape



Rectangular shape

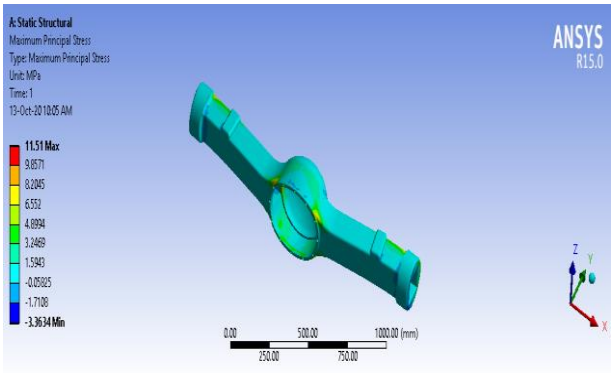
Equivalent stress results

Shape	Equivalent stress
Circular shape	15.036
Ellipse shape	14.384
Rectangular shape	12.26

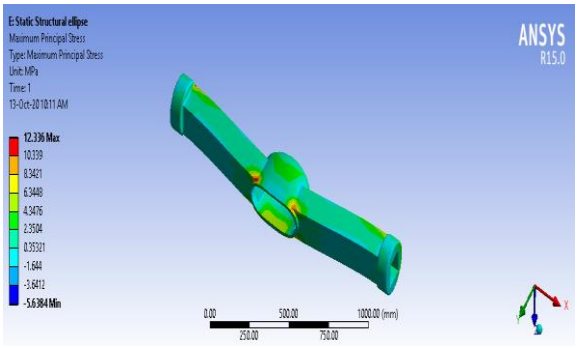


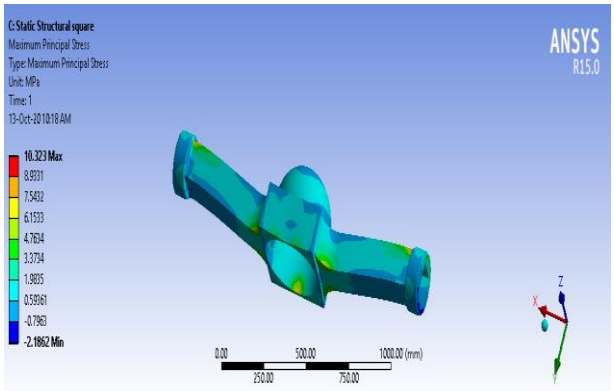
MAXIMUM PRINCIPLE STRESS

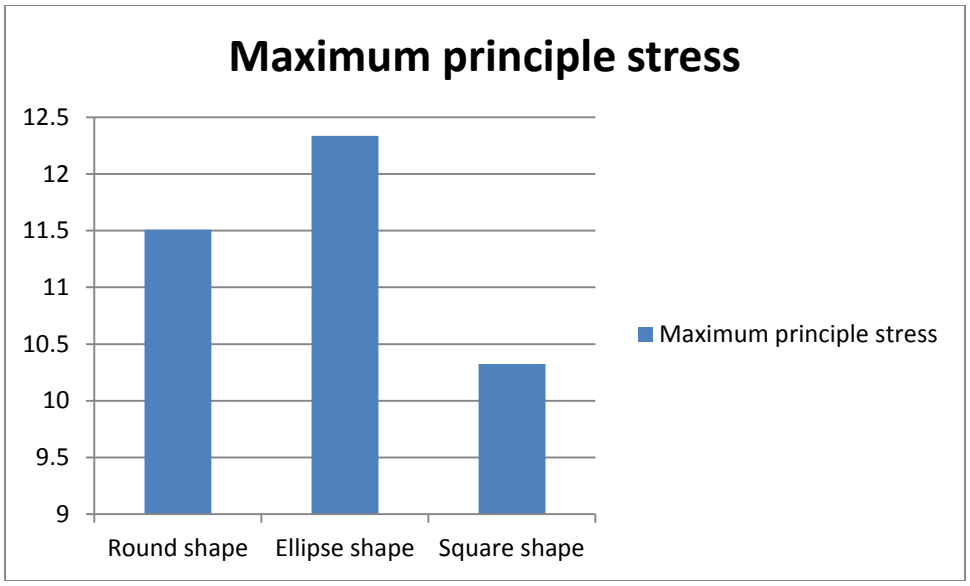
Circular shape



Ellipse shape



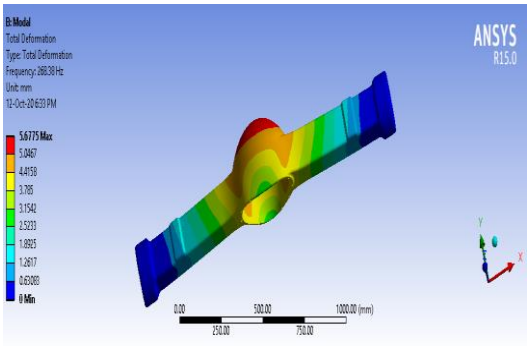


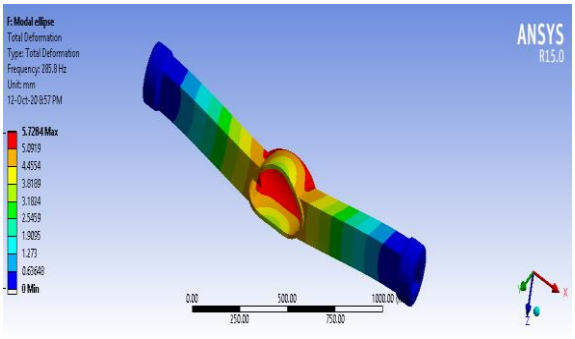


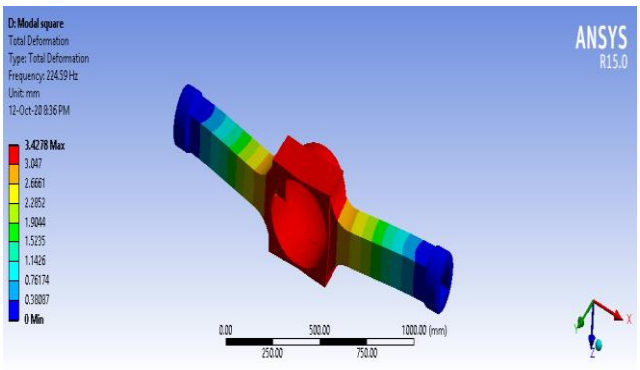
	Maximum principle stress
Circular shape	11.51
Ellipse shape	12.336
Rectangular shape	10.323

MODAL ANALYSIS

Frequency 1

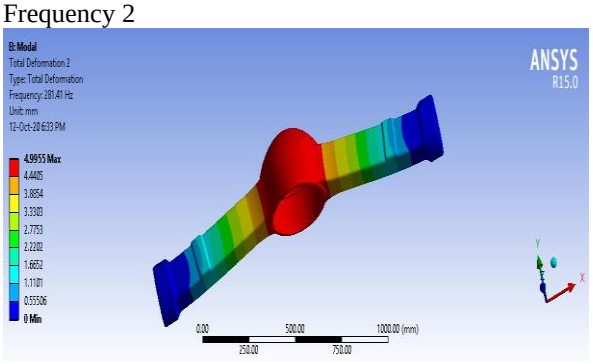




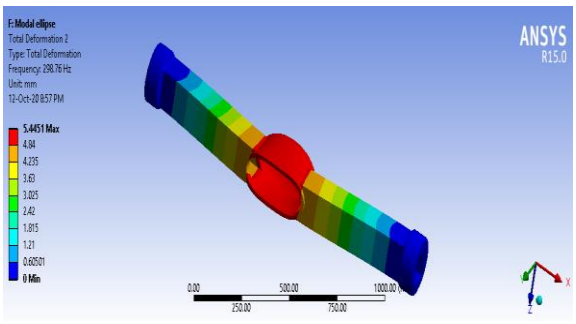


Rectangular shape

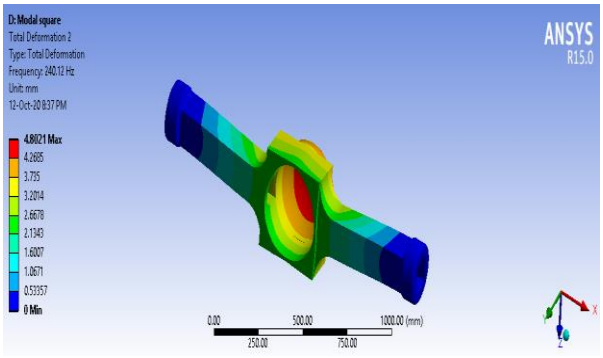
Frequency 2



Circular shape

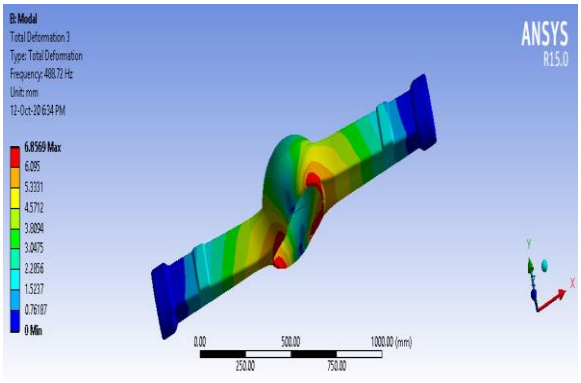


Ellipse shape

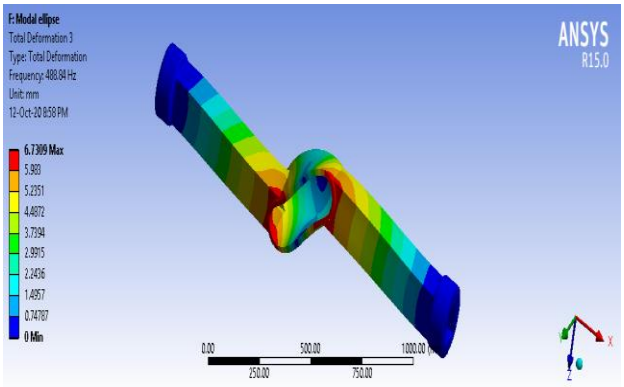


Rectangular shape

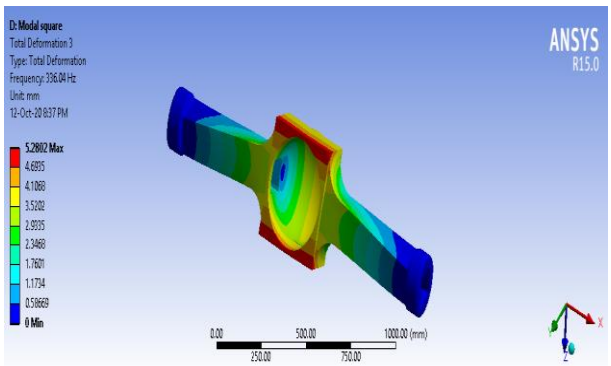
Frequency 3



Circular shape

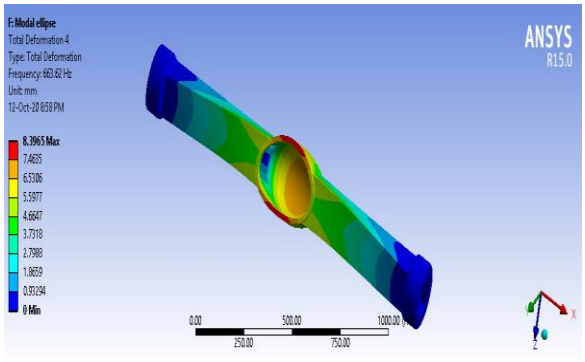


Ellipse shape

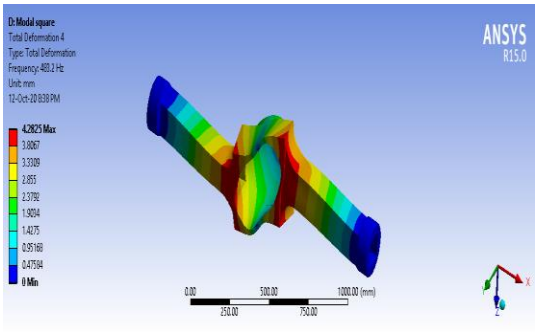


Rectangular shape

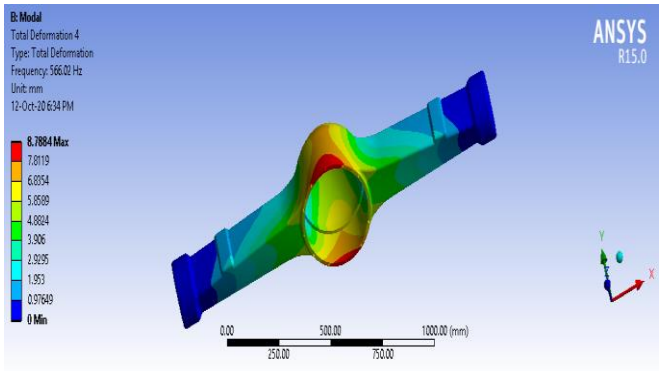
Frequency 4



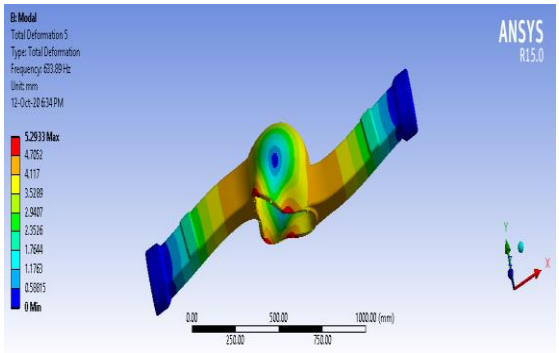
Ellipse shape



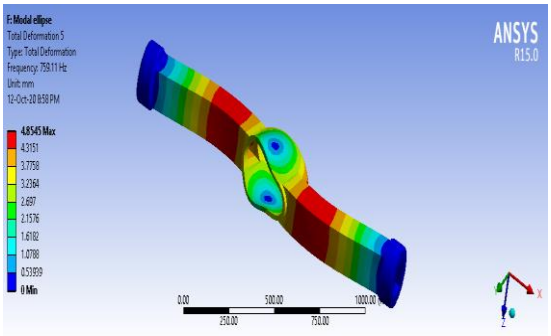
Rectangular shape



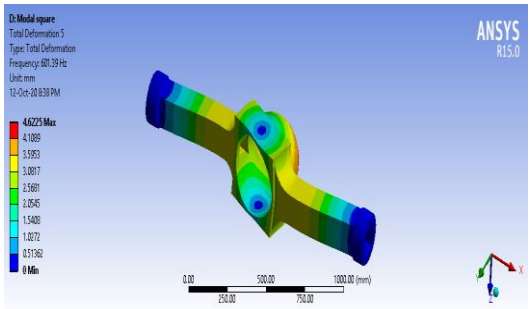
Frequency 5



Circular shape

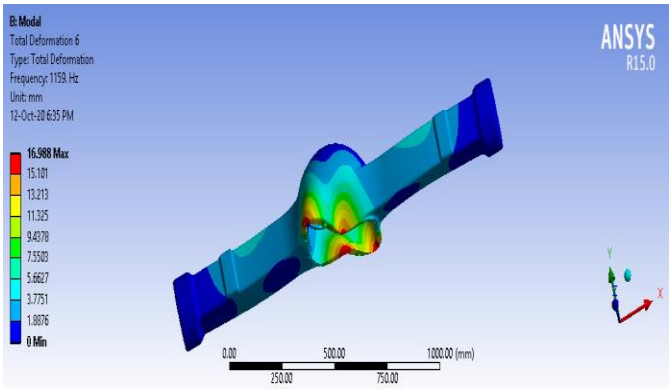


Ellipse shape

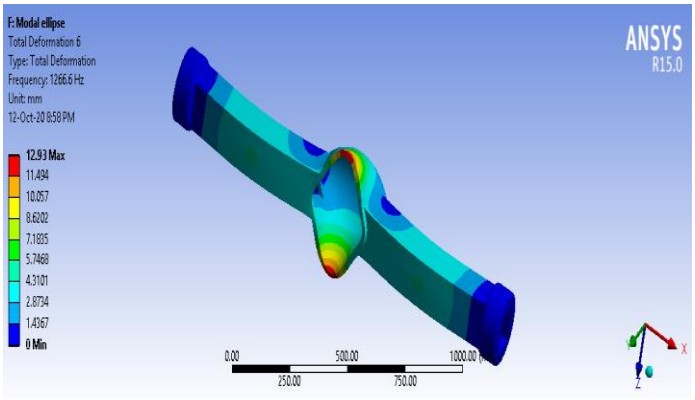


Rectangular shape

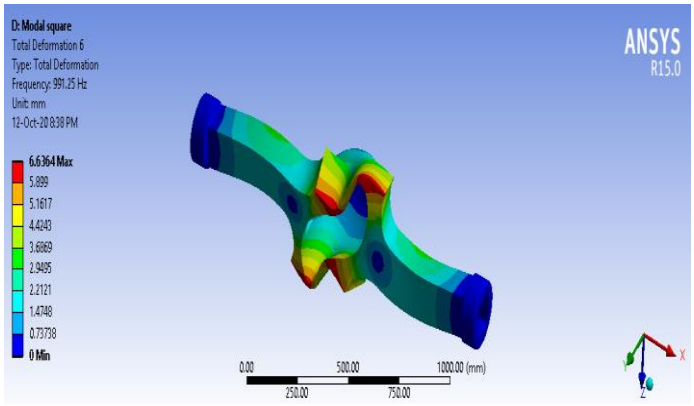
Frequency 6



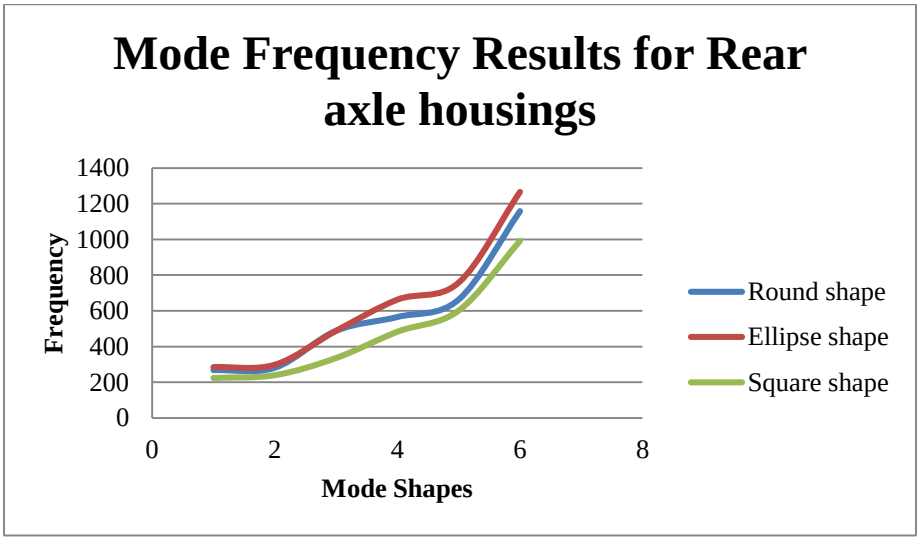
Circular shape



Ellipse shape



Rectangular shape



	Round shape	Ellipse shape	Square shape
Frequency 1	268.38	285.8	224.59
Frequency 2	281.41	298.76	240.12
Frequency 3	488.72	488.84	336.04
Frequency 4	566.02	663.62	483.2
Frequency 5	663.89	759.11	601.39
Frequency 6	1159	1266.6	991.25

Conclusion

From the results of rear axle housing structural and modal analysis of tractor axle with the various housing shapes like circular, ellipse shape and square shape of the housings, deformation of the housings rectangular shape got very less stress and principle stress also got very less in the applied load, the low stress results give more structural stability and model analysis rectangular shaped housings got very less mode frequency in dynamic performances also rectangular shape housings, so rectangular housings suitable for heavy duty applications

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